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Dear Katelyn

Determining the debt risk premium using the ERA's 'Bond Yield Approach'

The Australian Energy Market Operator (AEMO) engaged PricewaterhouseCoopers Australia (PwC) to advise the debt risk premium (DRP)¹ that would be derived by applying the Economic Regulation Authority of Western Australia's (ERA) 'Bond Yield Approach'. The estimate of the DRP will be used in conjunction with various other parameters to estimate a Weighted Average Cost of Capital (WACC), a necessary input into determining the 2017 Benchmark Reserve Capacity Price (BRCP). AEMO requested the DRP be estimated over the 20 business days ending on and including 14 October 2016 (the First Period) and 25 November 2016 (the Second Period). This letter provides our estimate of the DRP for both the First Period and Second Period.

As instructed by you, we have applied the ERA's 'Bond Yield Approach' that was set out in the ERA's Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline (Goldfields Decision)². AEMO requires PwC to use Australian corporate bonds which have a BBB (or equivalent) credit rating from Standard and Poor's, and Commonwealth Government Security (CGS) yields as the risk free rate in the determination of the DRP as per version 6 of AEMO's Market Procedure document.³

The ERA's 'Bond Yield Approach' changed following the Goldfields Decision. Compared with the 'Bond Yield Approach' from previous years, the new approach is much more extensive. A more detailed explanation is provided at Appendix A.

This advice is provided pursuant to the scope and terms set out in the consultancy agreement commencing 12 September 2016 between PwC and AEMO.

¹ For the avoidance of doubt the estimated DRP reflects only the risk margin attributable to debt financing, and not other debt related costs such as financing, arrangement and underwriting fees.

² See Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline (pages 565-592) - <https://www.erawa.com.au/cproot/14401/2/GGP%20-%20GGT%20-%20AA3%20-%20Amended%20Final%20Decision%20-PUBLIC%20VERSION.PDF>

³ <https://www.erawa.com.au/cproot/14362/2/Market%20Procedure%20-%20Maximum%20Reserve%20Capacity%20Price.pdf>



Results

As shown in Table 1 and Table 2 below, we have derived a DRP of 232 and 222 basis points for the First Period and Second Period, respectively. These estimates were derived by applying the ERA's 'Bond Yield Approach' to estimating a DRP, though restricting the sample of bonds to only those with a Standard and Poor's credit rating of BBB, and using CGS yields as the risk free rate.

The ERA's 'Bond Yield Approach' for regulated gas businesses uses a sample of bonds with a credit rating of between BBB- and BBB+. As part of the ERA's investigation into a WACC for regulated gas businesses, it found that Australian gas businesses had a credit rating that lied within the range BBB-, BBB to BBB+.⁴⁵ Further, the ERA's 'Bond Yield Approach' uses Australian Dollar interest rate swap yields as the risk free rate.

AEMO, in contrast to WA's regulated gas businesses and in accordance with its BRCP market procedures, can only:

- consider corporate bonds with a BBB credit rating;⁶ and
- use CGS yields as the risk free rate to estimate the DRP.

Although we have applied the ERA's 'Bond Yield Approach', to be consistent with the BRCP procedures we have restricted the sample of bonds to only those with a Standard and Poor's credit rating of BBB and applied CGS yields as the risk free rate to estimate the DRP. We note that this resulted in a sample of 46 bonds for the First Period, and a sample of 48 bonds for the Second Period.⁷

The ERA's 'Bond Yield Approach' required the application of three separate methodologies to estimate a DRP. These are the:

- Gaussian Kernel methodology (GS);
- Nelson-Siegel methodology (NS); and
- Nelson-Siegel Svensson methodology (NSS).

⁴ ERA, *Rate of Return Guidelines - Meeting the requirements of the National Gas Rules*, 16 December 2013

⁵ BBB credit rating band refers to a credit rating of BBB-, BBB and BBB+

⁶ <https://www.erawa.com.au/cproot/14362/2/Market%20Procedure%20-%20Maximum%20Reserve%20Capacity%20Price.pdf>

⁷ During the First Period, although the initial sample of bonds was 48 bonds the actual bond sample size was 46. Two bonds were excluded because they did not produce yield values for at least half of the averaging period, consistent with the ERA's 'Bond Yield Approach'. During the Second Period no additional relevant bonds were identified compared with the First Period. However, those two bonds that were excluded could now be included because they produced yields for the entire Second Period.



The DRP values estimated by applying GS, NS and NSS methodologies are averaged to estimate the final DRP. We observed that each methodology produced similar DRP values, shown in Table 1 and Table 2.

Table 1 – Summary of DRP estimates using the ERA’s ‘Bond Yield Approach’, restricted to bonds with a BBB credit rating – 20 business days to 14 October 2016 (basis points)

Methodology	DRP	Average DRP	Difference
Gaussian Kernel	232		0
Nelson-Siegel	230		-2
Nelson-Siegel Svensson	233	232	1

Source: PwC’s analysis applying the ERA’s ‘Bond Yield Approach’, Bloomberg

Table 2 – Summary of DRP estimates using the ERA’s ‘Bond Yield Approach’, restricted to bonds with a BBB credit rating – 20 business days to 25 November 2016 (basis points)

Methodology	DRP	Average DRP	Difference
Gaussian Kernel	225		3
Nelson-Siegel	218		-4
Nelson-Siegel Svensson	224	222	2

Source: PwC’s analysis applying the ERA’s ‘Bond Yield Approach’, Bloomberg

The DRP decreased from the First Period to the Second Period because CGS yields increased more than bond yields. Over these two periods, 10-year CGS yields increase by 41 basis points from 2.11% to 2.52%. However, the average 10-year bond yield estimated from the GS, NS and NSS methodologies only increased 31 basis points from 4.43% to 4.74%. CGS yields rising by 10 basis points more than the estimated average 10-year bond yield led to a drop in the average DRP by 10 basis points.

If you wish to discuss further the derivation of these estimates, please do not hesitate to call me on the number provided below.

Yours sincerely,

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Appendix A – ERA’s ‘Bond Yield Approach’

The ERA changed its ‘Bond Yield Approach’ in 2016 following its Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline (Goldfields Decision).⁸ Compared with the previous ‘Bond Yield Approach’ there are three major differences:

- Bond criteria - Bonds issued in foreign currencies are now accepted in the sample, but those issued by financial institutions or which are inflation-linked are now excluded.
- Estimation methodology – Estimating the DRP now follows a more extensive process. Instead of taking a simple weighted average of each bond’s DRP, the Gaussian Kernel methodology, Nelson-Siegel methodology, and Nelson-Siegel Svensson methodology are applied to estimate three individual 10 year DRPs, which are then averaged to estimate the final DRP.
- Risk free rate – Interest rate swap yields are used as the risk free rate, instead of Commonwealth Government Security yields.

A detailed exposition of the precise process of the ‘Bond Yield Approach’ is provided in the Goldfields Decision.⁹ We have provided the results of applying the bond criteria in Table 3 and Table 4 for the First Period and Second Period respectively, though only restricted to bonds with an S&P rating of BBB

Table 3 – Debt risk premium key statistics for 20 business days to 14 October 2016

Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
Amcor Finance USA Inc	BBB	USD	787	28/04/2026	9.58	4.21%
Amcor Finance USA Inc	BBB	USD	787	28/04/2026	9.58	4.21%
Amcor Ltd/Australia	BBB	EUR	777	16/04/2019	2.54	2.65%
Amcor Ltd/Australia	BBB	EUR	373	22/03/2023	6.48	3.59%
APT Pipelines Ltd	BBB	AUD	300	22/07/2020	3.81	3.33%
APT Pipelines Ltd	BBB	EUR	974	22/03/2022	5.48	3.87%
APT Pipelines Ltd	BBB	USD	731	11/10/2022	6.03	4.05%

⁸ See Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline (pages 565-592) - <https://www.erawa.com.au/cproot/14401/2/GGP%20-%20GGT%20-%20AA3%20-%20Amended%20Final%20Decision%20-PUBLIC%20VERSION.PDF>

⁹ See Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline (pages 565-592) - <https://www.erawa.com.au/cproot/14401/2/GGP%20-%20GGT%20-%20AA3%20-%20Amended%20Final%20Decision%20-PUBLIC%20VERSION.PDF>



Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
APT Pipelines Ltd	BBB	USD	731	11/10/2022	6.03	4.05%
APT Pipelines Ltd	BBB	GBP	536	26/11/2024	8.16	4.45%
APT Pipelines Ltd	BBB	USD	1,396	23/03/2025	8.48	4.67%
APT Pipelines Ltd	BBB	USD	1,396	23/03/2025	8.48	4.67%
APT Pipelines Ltd	BBB	EUR	905	22/03/2027	10.48	4.59%
APT Pipelines Ltd	BBB	GBP	1,154	22/03/2030	13.48	4.97%
APT Pipelines Ltd	BBB	USD	381	23/03/2035	18.48	5.68%
APT Pipelines Ltd	BBB	USD	381	23/03/2035	18.48	5.68%
AusNet Services Holdings Pty Ltd	BBB	USD	490	17/03/2076	59.46	4.60%
Brisbane Airport Corp Pty Ltd	BBB	AUD	200	9/07/2019	2.78	3.01%
Brisbane Airport Corp Pty Ltd	BBB	AUD	350	21/10/2020	4.06	3.21%
Crown Group Finance Ltd	BBB	AUD	450	18/11/2019	3.13	3.48%
Incitec Pivot Finance LLC	BBB	USD	873	10/12/2019	3.19	4.19%
Incitec Pivot Finance LLC	BBB	USD	873	10/12/2019	3.19	4.19%
Incitec Pivot Ltd	BBB	AUD	200	21/02/2019	2.39	3.38%
Perth Airport Pty Ltd	BBB	AUD	150	23/07/2020	3.81	3.46%
Perth Airport Pty Ltd	BBB	AUD	400	25/03/2021	4.49	3.62%
QPH Finance Co Pty Ltd	BBB	AUD	300	29/07/2020	3.83	3.16%
QPH Finance Co Pty Ltd	BBB	AUD	200	7/07/2021	4.77	3.33%
QPH Finance Co Pty Ltd	BBB	AUD	250	7/06/2023	6.69	3.60%
Sydney Airport Finance Co Pty Ltd	BBB	USD	509	22/02/2021	4.39	3.26%



Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
Sydney Airport Finance Co Pty Ltd	BBB	USD	509	22/02/2021	4.39	3.26%
Sydney Airport Finance Co Pty Ltd	BBB	AUD	200	20/11/2021	5.14	3.41%
Sydney Airport Finance Co Pty Ltd	BBB	AUD	750	11/10/2022	6.03	3.67%
Sydney Airport Finance Co Pty Ltd	BBB	USD	804	22/03/2023	6.48	3.78%
Sydney Airport Finance Co Pty Ltd	BBB	USD	804	22/03/2023	6.48	3.78%
Sydney Airport Finance Co Pty Ltd	BBB	EUR	1041	23/04/2024	7.56	3.76%
Sydney Airport Finance Co Pty Ltd	BBB	USD	633	30/04/2025	8.58	4.02%
Sydney Airport Finance Co Pty Ltd	BBB	USD	633	30/04/2025	8.58	4.02%
Sydney Airport Finance Co Pty Ltd	BBB	USD	1,180	28/04/2026	9.58	4.18%
Sydney Airport Finance Co Pty Ltd	BBB	USD	1,180	28/04/2026	9.58	4.18%
Transurban Queensland Finance Pty Ltd	BBB	AUD	250	8/12/2021	5.19	3.50%
Transurban Queensland Finance Pty Ltd	BBB	AUD	200	16/12/2024	8.21	4.19%
United Energy Distribution Pty Ltd	BBB	AUD	350	12/09/2023	6.95	3.65%
Woolworths Ltd	BBB	AUD	500	21/03/2019	2.48	3.00%
Woolworths Ltd	BBB	USD	784	22/09/2020	3.98	3.56%
Woolworths Ltd	BBB	USD	784	22/09/2020	3.98	3.56%
Woolworths Ltd	BBB	USD	527	12/04/2021	4.53	3.70%
Woolworths Ltd	BBB	USD	527	12/04/2021	4.53	3.70%

Source: PwC's analysis of the ERA's 'Bond Yield Approach', Bloomberg



Table 4 – Debt risk premium key statistics for 20 business days to 25 November 2016

Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
Amcor Finance USA Inc	BBB	USD	787	28/04/2026	9.46	4.55%
Amcor Finance USA Inc	BBB	USD	787	28/04/2026	9.46	4.55%
Amcor Ltd/Australia	BBB	EUR	777	16/04/2019	2.42	2.79%
Amcor Ltd/Australia	BBB	EUR	373	22/03/2023	6.36	3.90%
APT Pipelines Ltd	BBB	AUD	300	22/07/2020	3.69	3.45%
APT Pipelines Ltd	BBB	EUR	974	22/03/2022	5.36	4.08%
APT Pipelines Ltd	BBB	USD	731	11/10/2022	5.91	4.31%
APT Pipelines Ltd	BBB	USD	731	11/10/2022	5.91	4.31%
APT Pipelines Ltd	BBB	AUD	200	20/10/2023	6.93	4.07%
APT Pipelines Ltd	BBB	GBP	536	26/11/2024	8.03	4.76%
APT Pipelines Ltd	BBB	USD	1,396	23/03/2025	8.36	4.90%
APT Pipelines Ltd	BBB	USD	1,396	23/03/2025	8.36	4.89%
APT Pipelines Ltd	BBB	EUR	905	22/03/2027	10.36	4.95%
APT Pipelines Ltd	BBB	GBP	1,154	22/03/2030	13.36	5.31%
APT Pipelines Ltd	BBB	USD	381	23/03/2035	18.36	5.98%
APT Pipelines Ltd	BBB	USD	381	23/03/2035	18.36	5.98%
AusNet Services Holdings Pty Ltd	BBB	USD	490	17/03/2076	59.34	4.87%
Brisbane Airport Corp Pty Ltd	BBB	AUD	200	9/07/2019	2.65	3.17%
Brisbane Airport Corp Pty Ltd	BBB	AUD	350	21/10/2020	3.94	3.52%
Crown Group Finance Ltd	BBB	AUD	450	18/11/2019	3.01	3.83%
Incitec Pivot Finance LLC	BBB	USD	873	10/12/2019	3.07	4.32%



Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
Incitec Pivot Finance LLC	BBB	USD	873	10/12/2019	3.07	4.32%
Incitec Pivot Ltd	BBB	AUD	200	21/02/2019	2.27	3.53%
Perth Airport Pty Ltd	BBB	AUD	150	23/07/2020	3.69	3.65%
Perth Airport Pty Ltd	BBB	AUD	400	25/03/2021	4.36	3.77%
QPH Finance Co Pty Ltd	BBB	AUD	300	29/07/2020	3.71	3.30%
QPH Finance Co Pty Ltd	BBB	AUD	200	7/07/2021	4.65	3.54%
QPH Finance Co Pty Ltd	BBB	AUD	250	7/06/2023	6.56	3.94%
Sydney Airport Finance Co Pty Ltd	BBB	USD	509	22/02/2021	4.27	3.63%
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Sydney Airport Finance Co Pty Ltd	BBB	AUD	200	20/11/2021	5.02	3.37%
Sydney Airport Finance Co Pty Ltd	BBB	AUD	750	11/10/2022	5.91	3.63%
Sydney Airport Finance Co Pty Ltd	BBB	USD	804	22/03/2023	6.36	4.11%
Sydney Airport Finance Co Pty Ltd	BBB	USD	804	22/03/2023	6.36	4.11%
Sydney Airport Finance Co Pty Ltd	BBB	EUR	1041	23/04/2024	7.44	4.19%
Sydney Airport Finance Co Pty Ltd	BBB	USD	633	30/04/2025	8.46	4.34%
Sydney Airport Finance Co Pty Ltd	BBB	USD	633	30/04/2025	8.46	4.34%
Sydney Airport Finance Co Pty Ltd	BBB	USD	1,180	28/04/2026	9.46	4.50%
Sydney Airport Finance Co Pty Ltd	BBB	USD	1,180	28/04/2026	9.46	4.50%
Transurban Queensland Finance Pty Ltd	BBB	AUD	250	8/12/2021	5.07	3.67%
Transurban Queensland Finance Pty Ltd	BBB	AUD	200	12/10/2023	6.91	4.14%



Issuer Name	S&P Rating	Currency	Issuance size (\$m AUD)	Maturity	Term to maturity	Average yield (Semi-Annual)
Transurban Queensland Finance Pty Ltd	BBB	AUD	200	16/12/2024	8.09	3.94%
United Energy Distribution Pty Ltd	BBB	AUD	350	12/09/2023	6.83	4.00%
Woolworths Ltd	BBB	AUD	500	21/03/2019	2.35	3.04%
Woolworths Ltd	BBB	USD	784	22/09/2020	3.86	3.82%
Woolworths Ltd	BBB	USD	784	22/09/2020	3.86	3.82%
Woolworths Ltd	BBB	USD	527	12/04/2021	4.41	4.01%
Woolworths Ltd	BBB	USD	527	12/04/2021	4.41	4.01%

Source: PwC's analysis of the ERA's 'Bond Yield Approach', Bloomberg